Arizona State Retirement System Board

Asset Allocation Study

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Agenda

- Asset Allocation Paradigm
- Asset Allocation Policy Schematic
- Discussion of Asset Classes and Investment Strategies
- Strategic Asset Allocation Approaches
- Implementation
- Risk Budgeting Management
- Recommendations/Motions
- Appendix

Asset Allocation Paradigm

- **Asset Class vs. Investment Strategies**
  - Asset class: Represents economic sources of return which inherently earn a risk premium, i.e., basic market exposure (beta). Limited skill set/experience required, relatively low transaction costs/fees.
  - Investment strategies: Returns tend to be alpha dominated with returns derived by active risk management and not fully explained by movement in the market. Greater skilled/active management and access to information is required, generally involves higher transaction costs/fees.

- **Decision-Making Methodology**
  - Identify available asset classes and investment strategies
    - Analyze their primary characteristics; assess their suitability for institutional portfolios.
    - Evaluate sources of returns, risks, and diversification in terms of quantitative and qualitative considerations.
  - Utilize Efficient Frontier Mean-Variance Analysis
    - Identify model constraints (statutory, risk tolerances, etc.).
    - Evaluate multiple scenarios (iterative process).

- **Dynamic Asset Allocation Study Approach**
  - Periodicity of the Study should be better aligned to capture evolving or changing investment opportunities.
  - Reasonable to be initiated by the Director and CIO with the concurrence of the Investment Committee and Board Chairs.
  - In general, ASRS Asset Allocation Study to be conducted as warranted or triennially, whichever is shorter.

ASRS Asset Allocation Policy Schematic (Exhibit A)

Investment Category	Current Policy	Actual Alloc. 9/22/2006		Proposed Policy			
				Target	Range	Passive	Benchmark
US Equity							
Large Cap	43%	44%		31%	26 - 36%	65 ±10	S&P 500
Mid Cap	5	6		7	5 - 9	45 ±20	S&P 400
Small Cap	5	6		7	5 - 9	30 ±20	S&P 600
Sub-Total	53	56		45	40 - 50		
International Equity	15	18		18	13 - 20	10 ±5	MSCI ACWI ex. US
US Fixed Income	26	25		26	21 - 31	55 ±20	Lehman Aggregate
Real Estate	6	1		6	4 - 8	NA	NCREIF + 1%
Private Equity	0	0		5	3 - 7	NA	Russell 3000 + 3%
TOTAL	100	100		100			
Opportunistic Asset Classes:	0	1.5		0	0 - 5	NA	Asset Class Specific (TBD)
• Int'l Equity Small Cap	1.5	1.5		1.8	0 - 3.6	0	MSCI EAFE Small Cap
Global TAA	10	10.5		10	8 - 12	NA	ASRS Total Fund Benchmark
Expected Return	8.02%	8.22%		8.30%			
Standard Deviation	11.49%	12.03%		11.88%			
Sharpe Ratio	0.37	0.37		0.38			
Absolute Return Strategies	0	0		0	0 - 5	NA	> 0%

(Assumes: Maximum 5% Allocation, Volatility 3% Relative to Cash, Return: Cash + 3%, IR of 1.0)

Expected Return			8.43%
Standard Deviation			11.96%
Sharpe Ratio			0.39

Asset Classes (vertical label)
Strategies within Asset Classes: Beta exposure with active risk (vertical label)
Investment Strategies (vertical label)

Total Fund Benchmark: 31% Large Cap (S&P 500), 7% Mid Cap (S&P 400), 7% Small Cap (S&P 600), 18% Intl Equity (ACWI xUS)
   26% Fixed Income (Leh. Agg.), 6% Real Estate (NCREIF + 1%), 5% Private Equity (Russell 3000 + 3%)

Red denotes changes from ASRS existing Asset Allocation Policy which was approved by the Board in August 2003

NEPC Capital Markets Assumptions

Discussion of Asset Classes and Investment Strategies

- **US Equity**
  - The method for allocation of US Equity to large, mid and small cap is a two step process. First, the market weights are determined. Second, decisions are made to over-/under-weight these sub-asset classes based on an optimization exercise.
  - Step 1: The assumed US Equity market capitalization is 70% large cap, 20% mid cap and 10% small cap (based on a survey of ASRS investment managers and consultants). Applying these market weights to the ASRS 45% US Equity allocation results in the following allocations: 31% large cap, 9% mid cap, and 5% small cap.
  - Step 2: Optimal allocation over-weight small cap and under-weight mid cap relative to the broad US market. Moving from large to small cap increases expected return and increases volatility. Small cap market returns have exceeded large cap returns for the past six years. As such, the optimal allocation is 31% large cap, 7% mid cap, and 7% small cap.

- **International Equity**
  - A perspective on the recent rise in correlation between US and non-US equity markets.
    - Global markets are not that integrated nor should we expect their returns to be excessively correlated; today's high correlations are likely to be an aberration. The correlations are not rising in a steady pattern over time, instead they just fluctuate over time.
    - The relevant correlation for investors today is the correlation over the next several years.
    - The "correct" portfolio weights are given by optimization, in which correlation is only one of many inputs.
  - The case for increasing the allocation to International Equities is based on the following:
    - The US equity market is not a complete investment universe. The growth of non-US equity markets has resulted in the US representing approximately 50% of the global equity market. The remaining 50% is comprised of developed non-US markets and emerging markets.
    - Non-US economies, especially emerging markets, offer higher rates of long-term economic growth than the US.
    - Long-term diversification benefit.

Discussion of Asset Classes and Investment Strategies

- **Private Equity**

  - **Definition:**
    - Generally, viewed as any ownership interest that is not publicly traded. Includes a broad range of investments that allow for participation in the entire life cycle of an enterprise, from seed-stage startup through development and expansion to possible turnaround and distressed situations.
    - Sources of Return:
      - Economic factors and market exposure (beta-dominated)
      - Investors earn a risk premium for taking systematic (market) risk
  - **Advantages:**
    - Private equity differs from public equity in several ways:
      - In private equity, information does not flow freely
      - Private equity is highly illiquid
      - Transaction costs are high
      - Investors can focus on the long-term growth and profitability (instead of quarterly results)
  - **Implementation:**
    - IMD Staff member
    - Third-party investment advisor (potential RFP)
    - Capital drawdown process review
    - Benchmarks and performance measurement
    - Structure: universe, definitions, categories
    - Policies and Procedures
    - Statutory Changes (potential)

Discussion of Asset Classes and Investment Strategies

- **Opportunistic Asset Class**

  - Definition:
    - Investment opportunities that do not fall into clearly-defined asset classes and may be overlooked.
    - Opportunistic approach attempts to take advantage of changing market conditions.
    - Exposures driven by perceived changes in the relative values of various asset classes.
    - Exotic Beta: An exposure to a risk factor or an asset class that is both uncorrelated with global markets and has a positive expected return (e.g. commodities).
    - Risk tolerance and constraints are assumed to be constant (i.e. no material change in Total Fund risk).
  - Advantages:
    - Increase Total Fund risk-adjusted return as measured by the Sharpe Ratio (return per unit of risk).
      - Add value relative to the Total Fund benchmark.
      - Improve diversification of the Total Fund (i.e. eliminate all unsystematic, idiosyncratic, or unique risk).
 - Implementation:
    - Funding source and benchmark will be based on the characteristics of the investment opportunity.
    - Example: Micro Cap US Equity.
      - Benchmark: Russell Micro Cap Index
      - Objective: Outperform benchmark, improve Total Fund diversification, increase Total Fund Sharpe Ratio
    - Other examples: emerging markets debt, commodities, international equity small cap, infrastructure.

Discussion of Asset Classes and Investment Strategies

- **Absolute Return Strategies: Advantages and Conceptual Approach**

  - **Definition:**
    - Predominately alpha-dominated strategies whose return patterns are independent or less correlated to the market.
    - Sources of Return:
      - Active investment management of risks using superior skill and/or information.
      - Relaxed portfolio constraints (i.e. permit shorting).
      - Investors do not earn a risk premium.
  - **Advantages:**
    - Contributors to Total Fund alpha
    - Consistent Total Fund economic exposure
    - Efficient tracking error/alpha allocations/IR optimization
    - Opportunistic implementation
  - **Implementation:**
    - Common Approach
      - The most commonly used approach to an absolute return allocation is to consider absolute return strategies as part of the strategic asset allocation process in an alternatives asset class.
      - The strategic asset allocation process normally deals only with asset-class beta exposures defined by fully diversified market segments.
      - But absolute return strategies are an investment strategy, not an asset class. With this approach, investors are lumping absolute return strategies into an alternatives asset class and trying to force it into the SAA framework
    - Recommended approach: Active overlay at the Total Fund level (alpha pool)
      - Disentangle performance between market related and value added.
      - Any market or beta exposures in the absolute return strategy is hedged to maintain the SAA policy.
      - Conceptual consistency: beta and alpha separation.
      - Idea generation from Investment Committee Trustees, Director, IMD, and consultants.
      - Hedge any market exposure by using futures or physicals to maintain SAA policy ("beta transfer" or "beta neutral")

Discussion of Asset Classes and Investment Strategies

Absolute Return Strategies: Performance Framework

Strategy Decision

Execution Decision

Alpha Pool[1]

AROR 1   AROR 2   AROR 3

AROR 4   AROR 5
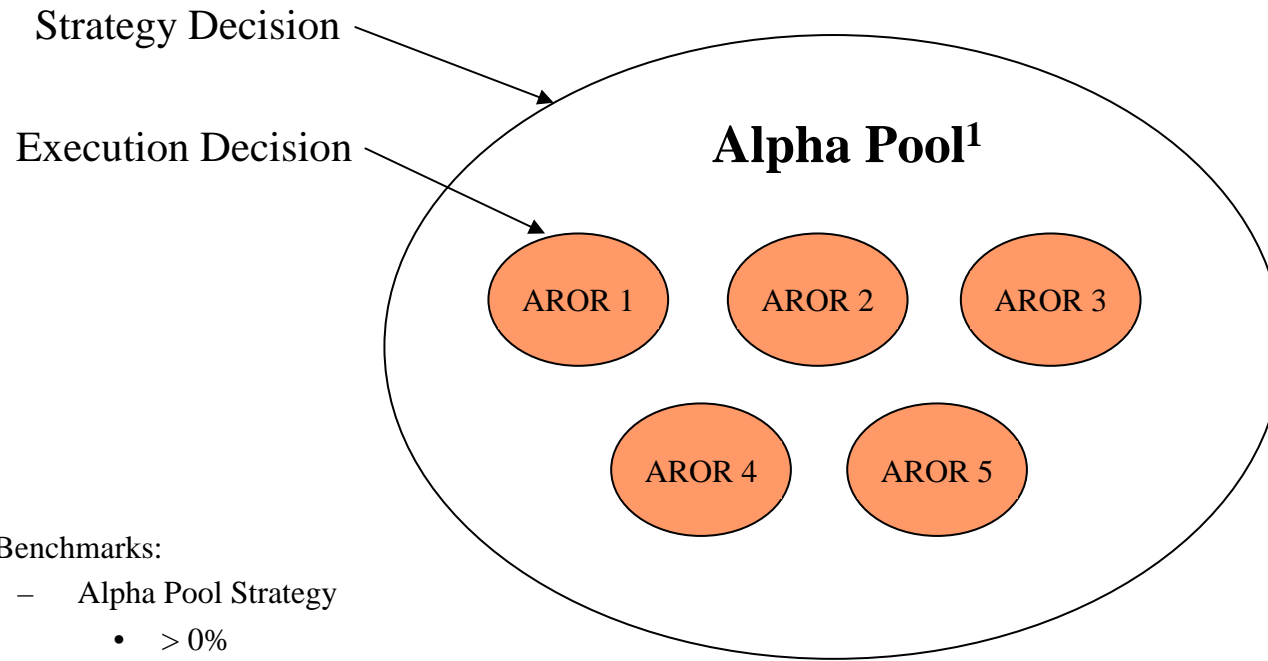
- Benchmarks:
  - Alpha Pool Strategy
    - > 0%
  - Individual AROR Strategies
    - TBD - Based on specific investment strategies
    - Examples:
      - Cash (LIBOR, T-Bills) + %
      - Inflation + %
      - Factor model (market exposures present)

[1] Active overlay at the Total Fund level. Transporting alpha back to any particular asset class is not necessary.

Discussion of Asset Classes and Investment Strategies

- **Total Fund Benchmark**

    - Includes all components of the Strategic Asset Allocation Policy.
    - Opportunistic asset classes are an attempt to add value relative to the Total Fund, therefore, they are not included in the Total Fund benchmark.
    - Absolute return strategies are designed to be market neutral and represent an active alpha overlay at the Total Fund level. In aggregate, the benchmark for the absolute return alpha pool is > 0%. Absolute return alpha is not included in the Total Fund benchmark.

Strategic Asset Allocation Approaches

- ## Traditional
  - Institutional investors have assumed:
    - The relationships among asset classes remain relatively constant when setting strategic asset allocations.
    - The set of available asset classes is constant during the traditional 3-year planning cycle.

- ## Dynamic
  - An alternative to the traditional 3-year policy asset mix review.
  - Investment opportunities and asset classes are constantly evolving and developing, such that they may become attractive and suitable for institutional investment portfolios before the next scheduled policy review.

Implementation

- Effective date on or before March 31, 2007

- Utilize an Interim Total Fund Benchmark (pro-rate Private Equity and Real Estate policy targets during programs' implementation period)

- Asset Class Allocations:
  - US Equity Large-Cap
    - Targeted funding source for private equity, real estate, and absolute return strategies.
  - US Equity Mid-Cap
    - No rebalancing or transition required, as current allocation is at or within asset class target/ranges.
  - US Equity Small-Cap
    - No rebalancing or transition required, as current allocation is at or within asset class target/ranges.
  - US Equity Small-Cap benchmark change:
    - Modify small-cap asset class benchmark from Russell 2000 to S&P 600.
    - Modify respective style performance benchmarks: DFA (S&P 600 Value) and Batterymarch (S&P 600 Growth).
    - Maintain the Russell 2500 Growth Index (SMID) for Times Square (growth).
    - Evaluate passive/index portfolio alternatives given Mellon Cap does not manage a small-cap S&P600 Index fund.
  - International Equity
    - No rebalancing or transition required, as current allocation is at or within asset class target/ranges.

Implementation (continued)

- Private Equity:
  - Conduct a private equity consultant search.
  - Recruit internal staff personnel.

- Absolute Return Strategies:
  - Conduct an absolute return strategy search for one or more consultants.

- Opportunistic Asset Class:
  - Proposals will be initiated by staff and/or consultants.

- GTAA:
  - Work with ASRS GTAA managers to modify their customized benchmark to reflect ASRS Total Fund benchmark in the context of existing international equity statutory limitations.

Risk Budgeting Management

- **Objectives**
  - Assess how risk is allocated between its market-related and active components as well as how effectively that risk is being spent.
  - Optimize risk capital (i.e. allocate capital in the most efficient manner).
  - Spend risk in the most efficient possible manner.
  - Strive to improve returns without adding additional risk by adjusting asset class or manager allocations.
  - Optimal portfolios allocate capital in proportion to information ratios and inversely proportional to active risk.

- **ASRS Risk Budgeting Initiative**
  - Risk budgeting management software
    - Cost/benefit analysis related to software
    - Vendors/software
      - Barclays Global Investors (BGI) – PortfolioWorks
      - Bridgewater – Risk Budgeting Software
      - Goldman Sachs Asset Management – Risk Budgeting Software
  - **Resources**
    - First evaluated by IMD in April 2005
    - Commitment to continuing education of IMD staff
    - Potential recruitment of an additional IMD staff member
    - Utilize expertise and resources of external managers and consultants

Recommendations/Motions

- Move to approve ASRS Asset Allocation Policy Schematic (Exhibit A) which contains policy targets/ranges for the ASRS broad asset classes, investment strategies, passive/active and GTAA program and benchmarks for the ASRS broad asset classes and Total Fund.

- Move to approve ASRS Dynamic Asset Allocation approach which initiates an asset allocation study based on market dynamics rather than set 3-year periodicity and provides for the potential introduction of new asset class on a periodic basis. An ASRS Asset Allocation Study will be conducted as a result of the aforementioned or triennially, whichever is shorter.

Appendix

- NEPC Asset Class Research
- NEPC Capital Market Assumptions
- ASRS Investment Goals and Objectives
- ASRS Strategic Asset Allocation Framework Memo

Passive/Active Allocation

- Over time, net of fees, the median active manager has
  - Added meaningful value in less efficient small-cap and international equity markets.
  - Failed to add value in the large cap core and core fixed income markets.
  - Rotation among active managers, particularly in the more-efficient markets, further weakens the rationale for using this approach there.
- In general, active management fares better in broad, well-diversified markets and passive management dominates in concentrated markets
  - To precisely determine the appropriate mix of actively managed and passively managed portfolios, we suggest a risk budgeting exercise that incorporates forward looking views on expected alpha, tracking error and fees for each of the ASRS managers to assist with the determination of the optimal portfolio structure. In the absence of a formal analysis, the ASRS current allocations and ranges are reasonable, however recommend modification in large-cap equity and fixed income.

Fixed Income

- Over longer periods of time, very few fixed income managers outperform the Lehman Aggregate benchmark by a substantial margin (i.e., >75 basis points) once fees are taken into account

- The median manager has exceeded the index by an average of 35-50 basis points over the three, five, seven and ten-year time periods on a before fee basis

- For trailing three through ten-year periods, the median core bond manager and the index have exhibited nearly identical risk/return characteristics

ASRS' current fixed income passive target at 75% is higher than where NEPC believes it should be. We believe that the target should be more in line with the actual allocation at around 55%.

Large Cap Equity

- Since 1992, the median active manager trailed the S&P 500, net of fees, approximately:
  - 67% of the rolling one-year periods
  - More than 50% of the rolling three- and five-year periods
- The return spread between the median active manager and passive management (both gross and net of fees) is tight over all cumulative time periods. Given the rotation of active managers over these multi-year periods, the odds of picking an active manager that will outperform are low
- For the trailing three through ten-year periods, the median large-cap core manager and the index have exhibited nearly identical risk/return characteristics

ASRS' current allocation to active management in the large cap area is consistent with the view that active management doesn't always pay off. However, NEPC believes that ASRS should make use of portable alpha strategies to enhance returns for some of the passive allocation.

Mid- and Small- Cap Equity

- During *rolling* time periods since 1992, the median small cap core equity manager beat the Russell 2000, net of fees:
  - 70% of the rolling one-year periods
  - Better than 89% of the rolling three- and five-year periods
- The median small cap equity manager surpassed the Russell 2000 over the *trailing* five, seven and ten-year periods
  - R2K was fourth quartile performance in each period
- Performance differentials are narrow over recent one and three-year periods, but pronounced over the longer term
- Risk differentials favor active management materially over all periods from three through ten years in length

ASRS' current allocation to active management in the mid and small cap area should be increased modestly to take advantage of the market inefficiencies exhibited by this asset class.

International Equity

- Since 1992, the median international equity manager has outperformed the MSCI EAFE index, net of fees
  - 67% of the rolling one-year periods
  - 85% of the rolling three-year periods
  - 98% of the rolling five-year periods
- EAFE ranks poorly within the international equity universe over the one, three, five, seven and ten-year periods
  - Fourth quartile performance for the five, seven, and ten-year periods
  - Third quartile performance over the one- and three-year periods
- Of note, the median international equity manager's outperformance was accomplished at comparable risk levels to EAFE over all multiple-year periods

ASRS' current allocation to active management for international equities is in line with NEPC's view on the ability of active management to consistently add value in this asset class.

Growth/Value Style Investing - US

- Over time (from 1970-2006), large cap value has outperformed large cap growth
  - For 54% of the monthly periods since Jan, 1979, the R1000 Value index has outperformed the R1000 Growth Index, for an annualized 14.96% return versus a 12.16% return
  - The volatility of R1000 Value has been less than R1000 Growth for the period.
  - Investors broadly agree that investment style can be a valuable source of added returns and diversification

- Notwithstanding these generalizations, NEPC believes that in the domestic markets, a strategic tilt toward value is not warranted, and that a systematic approach to rebalancing to a 50/50 mix provides the best trade-off of return/tracking error
  - Supported by Alliance-Bernstein paper on managing style. (appendix)
  - Rebalancing should be done carefully given the long-cycle persistence of growth/value or value growth. There may be merit in using asymmetric bands in choosing to rebalance

Growth/Value Style Investing – International

- Style data on international indices covers shorter time periods and suffers from significant construction methodology

  – MSCI, the most widely used international index provider had significant construction flaws in value/growth until quite recently.

  – Performance of international managers is less clearly split into value and growth, particularly in Small Cap International and Emerging Markets.

- Given the construction issues, we would tend to focus more on the performance of international managers and allow manager performance to drive style mix, only focusing on rebalancing when a new manager is added or the size of the overall allocation to the asset class is modified

Benchmark Modifications

Small Cap

- S&P Small Cap 600 Index

    - The Index provides better "coverage" of the small cap universe.

    - It contains a mixture of more stable and profitable firms more so than the Russell 2000.

    - While not guaranteed by theory, the S&P600 has outperformed the Russell 2000.

Private Equity

- Russell 3000 + 300 basis points

    - Represents all facets of Private Equity, from venture capital to buyouts to mezzanine.

    - Returns more accurately tracks Private Equity performance.

NEPC Capital Market Assumptions
Risk/Return

	Forecast Risk (volatility of returns)	Expected Return (net of fees)
Inflation	1.00%	3.00%
Cash	1.25%	3.75%
Core Bonds	6.75%	5.00%
TIPS	6.00%	4.75%
Long G/C Bonds	11.00%	5.00%
High Yield Bonds	10.75%	6.50%
Global Bonds	9.25%	4.75%
Emerging Debt	16.00%	6.75%
Real Estate	11.50%	6.75%
Large Cap	16.00%	8.50%
Mid Cap	19.50%	8.75%
Small Cap	22.50%	9.00%
Int'l Equity	19.00%	9.00%
Int'l Small Cap	24.00%	9.50%
Emerging Markets	27.00%	10.00%
Private Equity	27.00%	10.50%
Commodities	15.00%	5.00%
Hedge Funds Cons	7.00%	6.25%
Hedge Funds Mod	10.00%	7.75%

Due to the nature of hedge funds, these assumptions include an alpha expectation

Source: New England Pension Consultants

NEPC Capital Market Assumptions
Correlations

Asset Class	Core	Long	Global	RE	Large	Mid	Small	Intl	Intl Sm	Emg	PE	AR	Comm
Core Bonds	1.00												
Long Bonds	0.95	1.00											
Global Bonds	0.70	0.60	1.00										
Real Estate	(0.10)	(0.20)	(0.10)	1.00									
Large Cap Equities	0.20	0.20	(0.10)	0.00	1.00								
Mid Cap Equities	0.15	0.15	(0.15)	(0.05)	0.90	1.00							
Small Cap Equities	0.00	0.10	(0.20)	(0.05)	0.80	0.90	1.00						
Int'l Equities	0.00	0.05	0.30	0.10	0.60	0.55	0.55	1.00					
Int'l Small Cap Eq	0.00	0.00	0.10	0.00	0.45	0.45	0.45	0.90	1.00				
Emerg Int'l Equities	(0.20)	(0.30)	0.00	(0.10)	0.40	0.40	0.40	0.55	0.50	1.00			
Private Equity	0.15	0.10	(0.05)	0.00	0.75	0.80	0.85	0.50	0.60	0.25	1.00		
Absolute Return	0.35	0.35	0.00	(0.10)	0.20	0.20	0.20	0.05	0.00	0.00	0.10	1.00	
Commodities	(0.10)	(0.10)	(0.10)	0.05	(0.20)	(0.20)	(0.20)	(0.10)	(0.10)	(0.10)	0.00	0.00	1.00

Source: New England Pension Consultants

ASRS Investment Program Investment Goals

- Goal #1: Achieve a total fund rate of return equal to or greater than the actuarial assumed interest rate.

- Goal #2: Achieve a total fund rate of return equal to or greater than the asset allocation benchmark.

- Goal #3: Achieve a total fund rate of return equal to or greater than the amount projected in the most recent asset allocation study.

- Goal #4: Achieve asset class net rates of return equal to or greater than their respective broad asset class benchmarks.

- Goal #5: Achieve portfolio-level net rates of return equal to or greater than their respective portfolio benchmarks.

- Goal #6: Ensure sufficient monies are available to meet cash flow requirements.

ASRS Strategic Plan, February 28, 20006